

Claims

1 1. A method of providing a cell with herbicide resistance comprising the steps
2 of:
3 providing a polynucleotide comprising polynucleotide sequences encoding
4 the enzymes of the complete mevalonate pathway;
5 introducing said polynucleotide into a plurality of target cells;
6 contacting said cells with an herbicide that targets a component of a non-
7 mevalonate pathway; and
8 selecting at least one target cell which exhibits herbicide resistance.

1 2. The method according to claim 1, wherein said target cell is a plant cell.

1 3. The method according to claim 1, wherein said target cell is a microalgae cell.

1 4. The method according to claim 2, wherein said polynucleotide is introduced
2 into a plastid of said target cell.

1 5. The method according to claim 3, wherein said polynucleotide is introduced
2 into a plastid of said target cell.

1 6. The method according to claim 1, wherein said polynucleotide further
2 comprises a sequence encoding IPP isomerase.

1 7. The method according to claim 2, wherein said polynucleotide comprises a
2 sequence encoding IPP isomerase.

1 8. The method according to claim 3, wherein said polynucleotide comprises a
2 sequence encoding IPP isomerase.

1 9. The method according to claim 4, wherein said polynucleotide comprises a
2 sequence encoding IPP isomerase.

1 10. The method according to claim 5, wherein said polynucleotide comprises a
2 sequence encoding IPP isomerase.

1 11. An isolated polynucleotide encoding *R. capsulatus* IPP isomerase, said
2 polynucleotide comprising the sequence of SEQ ID NO: 55.

1 12. A method for producing a transformed plant comprising the steps of:
2 providing a polynucleotide comprising polynucleotide sequences encoding
3 the enzymes of the complete mevalonate pathway;
4 introducing said polynucleotide into a plurality of target plant cells;
5 selecting at least one plant cell transformed with said polynucleotide; and
6 regenerating said at least one plant cell into a transformed plant.

1 13. A method according to claim 12, wherein said polynucleotide is introduced
2 into a plastid of said target plant cell, and wherein said plant is a transplastomic plant.

1 14. A plant produced by the method of claim 11.

1 15. A plant according to claim 14, wherein said plant is a transplastomic plant.

1 16. A method for providing transformed cells having increased isoprenoid
2 production as compared to non-transformed cells, comprising the steps of:
3 providing an isolated polynucleotide comprising polynucleotide sequences
4 encoding the enzymes of the complete mevalonate pathway;
5 providing a plurality of target cells;
6 introducing said isolated polynucleotide into said target cells;
7 selecting target cells which have been transformed with said polynucleotide; and
8 growing said transformed cells under conditions whereby additional generations
9 of descendant transformed cells are produced, said transformed cells exhibiting increased
10 isoprenoid production as compared to non-transformed cells of the same type.

1 17. The method according to claim 16, wherein said isolated polynucleotide
2 further comprises the polynucleotide sequence encoding IPP isomerase.

1 18. The method of claim 16, wherein said target cells are microalgae.

1 19. The method of claim 17, wherein said target cells are microalgae.

1 20. The method of claim 16, further comprising the step of regenerating said
2 transformed cells into a transformed plant, wherein said transformed plant exhibits
3 increased isoprenoid production as compared to a non-transformed plant of the same type.

1 21. A plant produced by the method of claim 20.

1 22. Descendants of the plant of claim 21, wherein said descendants exhibit
2 increased isoprenoid production as compared to non-transformed plants of the same type.

1 23. A method of providing a cell with antibiotic resistance comprising the steps
2 of:

3 providing a polynucleotide comprising polynucleotide sequences encoding
4 the enzymes of the complete mevalonate pathway;
5 introducing said polynucleotide into a plurality of target cells;
6 contacting said cells with an antibiotic that targets a component of a non-
7 mevalonate pathway; and
8 selecting at least one target cell which exhibits antibiotic resistance.

1 24. The method according to claim 23, wherein said target cell is a plant cell.

1 25. The method according to claim 24, wherein said target cell is a microalgae
2 cell.

1 26. The method according to claim 24, wherein said polynucleotide is introduced
2 into a plastid of said target cell.

1 27. The method according to claim 25, wherein said polynucleotide is introduced
2 into a plastid of said target cell.

1 28. The method according to claim 23, wherein said polynucleotide further
2 comprises a sequence encoding IPP isomerase.

1 29. The method according to claim 24, wherein said polynucleotide comprises
2 a sequence encoding IPP isomerase.

1 30. The method according to claim 25, wherein said polynucleotide comprises
2 a sequence encoding IPP isomerase.

1 31. The method according to claim 26, wherein said polynucleotide comprises
2 a sequence encoding IPP isomerase.

1 32. The method according to claim 27, wherein said polynucleotide comprises
2 a sequence encoding IPP isomerase.

1 33. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 58.

1 34. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 59.

1 35. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 60.

1 36. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 61.

1 37. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 62.

1 38. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 63.

1 39. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 64.

1 40. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 72.

1 41. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 73.

1 42. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 74.

1 43. The method according to claim 1, wherein said polynucleotide comprises the
2 polynucleotide sequence of SEQ ID NO: 76.

1 44. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 58.

1 45. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 59.

1 46. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 60.

1 47. The method according to claim 12, wherein said polynucleotide comprises

2 the polynucleotide sequence of SEQ ID NO: 61.

1 48. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 62.

1 49. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 63.

1 50. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 64.

1 51. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 72.

1 52. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 73.

1 53. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 74.

1 54. The method according to claim 12, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 76.

1 55. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 58.

1 56. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 59.

1 57. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 60.

1 58. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 61.

1 59. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 62.

1 60. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 63.

1 61. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 64.

1 62. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 72.

1 63. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 73.

1 64. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 74.

1 65. The method according to claim 16, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 76.

1 66. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 58.

1 67. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 59.

1 68. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 60.

1 69. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 61.

1 70. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 62.

1 71. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 63.

1 72. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 64.

1 73. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 72.

1 74. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 73.

1 75. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 74.

1 76. The method according to claim 23, wherein said polynucleotide comprises
2 the polynucleotide sequence of SEQ ID NO: 76.

1 77. An isolated polynucleotide comprising polynucleotide sequences encoding
2 the enzymes of the complete mevalonate pathway, said polynucleotides comprising a
3 sequence selected from the group consisting of SEQ ID NO: 58, SEQ ID NO: 59, SEQ
4 ID NO: 60, SEQ ID NO: 61, SEQ ID NO: 62, SEQ ID NO: 63, SEQ ID NO: 64, SEQ ID

5 NO: 72, SEQ ID NO: 73, SEQ ID NO: 74, and SEQ ID NO: 76.

1 78. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 58.

1 79. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 59.

1 80. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 60.

1 81. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 61.

1 82. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 62.

1 83. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 63.

1 84. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 64.

1 85. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 72.

1 86. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 73.

1 87. An isolated polynucleotide according to claim 77, wherein said

2 polynucleotide comprises the sequence of SEQ ID NO: 74.

1 88. An isolated polynucleotide according to claim 77, wherein said
2 polynucleotide comprises the sequence of SEQ ID NO: 76.

1 89. An isolated polynucleotide comprising the sequence of SEQ ID NO: 75.

1 90. A method of providing a cell with an inserted polynucleotide sequence
2 encoding one or more products of interest comprising the steps of:
3 providing a plurality of target cells having an identified pseudogene site therein;
4 providing an isolated polynucleotide comprising polynucleotide sequences of said
5 pseudogene site flanking at least one coding sequence of interest;
6 introducing said polynucleotide into a plurality of said target cells;
7 selecting at least one target cell which contains the coding sequence of interest
8 inserted into said pseudogene site .

1 91. The method according to claim 90, wherein said pseudogene is a defunct
2 gene located in an active operon from which monocistronic or polycistronic RNA is
3 produced.

1 92. The method according to claim 91, wherein said operon is the *rpl23* operon
2 .

1 93. The method according to claim 91, wherein said pseudogene is *infA*.

1 94. The method according to claim 90, wherein the inserted polynucleotide is
2 operably linked to the regulatory sequences of the pseudogene.

1 95. The method according to claim 94, wherein the inserted polynucleotide is
2 operably linked to the regulatory sequences of the *rpl23* operon.

1 96. The method according to claim 94, wherein the inserted polynucleotide is

2 operably linked to the regulatory sequences of *infA*.

1 97. The method according to claim 90, wherein the isolated polynucleotide
2 further comprises additional flanking sequences that themselves flank the pseudogene
3 sequences, and wherein said additional flanking sequences, in their native state, flank the
4 pseudogene in its native state.

1 98. The method according to claim 97, wherein the inserted polynucleotide
2 replaces the pseudogene in its entirety.

1 99. The method according to claim 97, wherein said additional flanking sequences
2 are native plastid sequences.

1 100. The method according to claim 90, wherein said target cell is a plant cell.

1 101. The method according to claim 90, wherein said target cell is a microalgae
2 cell.

1 102. The method according to claim 100, wherein said polynucleotide is
2 introduced into a plastid of said target cell.

1 103. The method according to claim 101, wherein said polynucleotide is
2 introduced into a plastid of said target cell.

1 104. The method according to claim 100, wherein said plant cell is selected from
2 the group consisting of the rosids, asterids, and liliales.

1 105. The method according to claim 100, wherein said plant cell is from a
2 solanaceous species.

1 106. The method according claim 105, wherein said plant cell is selected from
2 the group consisting of petunia, tomato, potato, and tobacco cells.

1 107. The method according to claim 90, wherein said coding sequence of interest
2 comprises polynucleotide sequences encoding the enzymes of the complete mevalonate
3 pathway.

1 108. The method according to claim 90, wherein said polynucleotide further
2 comprises a sequence encoding IPP isomerase.

1 109. The method according to claim 107, wherein said polynucleotide further
2 comprises a sequence encoding IPP isomerase.

1 110. The method according to claim 90, wherein said polynucleotide comprises
2 polynucleotide sequences encoding phytoene synthase.

1 111. The method according to claim 90, wherein said polynucleotide is
2 promoterless.

1 112. A method according to any of claims 100, 102, 104, 105, and 106, said
2 method further comprising the step of regenerating said selected target cell into a plant,
3 said plant comprising said coding sequence of interest.

1 113. A plant produced by the method of claim 112.

1 114. Descendants of the plant of claim 113, said descendant plants comprising
2 said coding sequence of interest.